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I also certify that the attached copy of the request for grant of a Patent (Form 1/77) bears an amendment, effected by this office, following a request by the applicant and agreed to by the Comptroller-General.

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Dated 15 November 2004

Patents Form 1/77

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11NOV03 E851072-1 B18072
P01/7700 0.00-0326204.5

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

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1. Your reference

2. Patent application number
(The Patent Office will fill this part in)
10 NOV 2003
0326204.5
/MICHAEL AIL 9.1.04

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*
DAVID M THROWER
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WOKINGHAM, BERKS RG40 2LP

Patents ADP number *(if you know it)*
8749962001

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention
LAWN AERATOR

5. Name of your agent *(if you have one)*
Boult Wade Tennant

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*
Verulam Gardens
70 Grays Inn Road
London
WC1X 8BT.

Patents ADP number *(if you know it)*

6. Priority: Complete this section if you are declaring priority from one or more earlier patent applications, filed in the last 12 months.

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. Divisionals, etc: Complete this section only if this application is a divisional application or resulted from an entitlement dispute (see note f)

Number of earlier UK application	Date of filing *(day / month / year)*

8. Is a Patents Form 7/77 (Statement of inventorship and of right to grant of a patent) required in support of this request?
NO

Answer YES if:
a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
Otherwise answer NO (See note d)

Patents Form 1/77

9. Accompanying documents: A patent application must include a description of the invention. Not counting duplicates, please enter the number of pages of each item accompanying this form:

Continuation sheets of this form	
Description	4
Claim(s)	1
Abstract	1
Drawing(s)	9 + 9 SN

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent (Patents Form 7/77)	
Request for a preliminary examination and search (Patents Form 9/77)	~~YES~~
Request for a substantive examination (Patents Form 10/77)	~~YES~~
Any other documents (please specify)	

11. I/~~We~~ request the grant of a patent on the basis of this application.

Signature(s) D THROWER Date 7 NOV. 2003

12. Name, daytime telephone number and e-mail address, if any, of person to contact in the United Kingdom

DAVID THROWER
0118 9776011
DAVID.THROWER@F2S.COM

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Notes

a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.

b) Write your answers in capital letters using black ink or you may type them.

c) If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.

d) If you have answered YES in part 8, a Patents Form 7/77 will need to be filed.

e) Once you have filled in the form you must remember to sign and date it.

f) Part 7 should only be completed when a divisional application is being made under section 15(4), or when an application is being made under section 8(3), 12(6) or 37(4) following an entitlement dispute. By completing part 7 you are requesting that this application takes the same filing date as an earlier UK application. If you want the new application to have the same priority date(s) as the earlier UK application, you should also complete part 6 with the priority details.

LAWN AERATOR

This invention relates to a powered lawn aerator.

Background of the invention

It has long been known that grass lawns and turfed areas benefit from their roots having direct access to fertilisers, air and oxygen to improve growing conditions and this has been addressed by machines which punch a series of holes into the lawn surface: a system known as aeration. Not only does aeration provide the direct access to the root zone but it helps ease compaction of the soil caused by pedestrian traffic, thereby creating a better growing environment and encouraging deeper root growth, which also helps the finer grasses to surface. Aeration is also used to change the composition of the soil over time by removing plugs of, say clay, and filling these holes with a loam mixture, a more conducive growing medium.

There are two methods of aerating depending on the type of tine used to make the holes, normally 10-15mm in diameter. The solid tine tends to be used on large areas of grassland e.g. golf fairways, to facilitate movement of air and water; however these solid spikes add to the problems of compaction. The preferred method is to hollow tine whereby cores of soil are removed. This method creates minimum added compaction around the walls of the hole.

Hollow tines come in two guises; either tractor mounted or pedestrian walk-behind machines. Many use a heavy rotary drum system with tines attached, and as the drum passes over the lawn, the weight of the drum forces the static tines into the ground. However this does create problems for as the tine enters the ground at an angle, it tends to tear the grass and create compaction at the point of entry. Similarly, as the tine leaves at an angle at the opposite side of the hole, it tends to pull the surrounding soil up, leaving a ridge. The remedy for this is often to use a roller to get the lawn surface back to its flat surface. Improvements to the rotary drum type are machines where the static tines penetrate the soil vertically, usually by the use of camshafts. However these machines need to be heavy in order to exert the force necessary for pushing the static tines down into the surface. The use of static hollow tines is common and relies on the subsequent penetration to force the soil core from the previous hole up the barrel of the tine and out through a chute. Where the soil is heavy and of a viscous nature, e.g. clay, this tends to clog the barrel resulting in further penetrations not being able to lift the soil and results in performing more like a solid tine, causing greater compaction.

One other method is to use drill bits, similar to masonry drills, which are hydraulically driven into the ground. This rotating drill method requires less downward force to penetrate the soil than static tines. However these drills have a downward cutting force rather than a scooping action, and as the distance between the inner shank and the outer cutting edge is minimal resulting in lesser soil being carried to the surface, both contribute to a degree of compaction. The removed soil forms a volcanic ridge around each hole and is removed by sweeping or blowing to the edge of the lawn for later collection and removal. Being denser, the cores of soil on the surface created by hollow tining are subsequently removed by 'sweeping' machines.

All of the machine aerators are aimed at the professional market, although some pedestrian models can be used by domestic gardeners, but problems often arise due to limited access through gateways and poor manoeuvrability. The domestic gardener is then left with few poor choices, each of which requires considerable manual dexterity. The garden fork is still used by

the most enthusiastic of gardeners as a form of solid spike aerating, and there are versions of garden tools with solid and hollow tines, which are again forced into the ground by foot force. The only other choice is a rotary drum tool which has solid tines attached and by manually forcing both a downward and forward weight do the tines make some indentations and forward movement.

Essential Features

Accordingly, the following detailed description provides a powered device which overcomes the deficiencies noted above by constructing an aerator which:

a) has special drill bits with a double claw tip which cuts the soil vertically and 'scoops' the soil particles upwards. The drill bits are designed to convey the maximum available amount of soil, transporting it upwards via a helical staircase and up through the tine tube, above which is mounted a thrower disc which deflects the upward moving soil down into a collection box.

b) The drill shanks are held in place in a carousel, and through the centre of each carousel is a double-tension push-tube. At the first stage when the push-tube is compressed, the whole drill and tine tube assembly enter the surface of the lawn, enabling the tine tubes to have firm contact between the lawn and the soil-collection box. As the push-tube continues down in its second stage, the tine tubes stay in situ and the drills enter the soil.

c) When a hard stone e.g. flint is encountered within the soil, current aerators either continue with an equal amount of pressure upon each tine, resulting in damaged tines, or when a solid surface is struck, the machine stops. This aerator has a novel solution as each drill is held in place at its upper end by a constant tension spring which is set at a predetermined load equal to the required downward force required for drilling into the soil. When the drill hits a solid surface and meets resistance, the continuing downward thrust creates enough force to exceed this predetermined load, the spring mechanism allowing compliance for the drill thereby impeding further efforts to exert downward pressure on the drill bit. The remaining drills continue downwards uninterrupted.

d) Each drill is driven by its own pulley, probably driven by a master reduction set according to the power unit properties. The aerator can easily provide for different powering options as it can have its own dedicated motor, electric or petrol. For the home gardener with lighter usage and seeking a cheaper motor-less option, he can use his own power drill (within its allowable performance), connecting to the master drive pulley via the chuck, with the power drill being held in place by a holster.

e) Although a drilling motion requires less force to penetrate the soil compared to a static tine, a degree of physical force is still required. Using the principles of physics, there are elongated handles with the handle knobs some way distant from the push-rods, resulting in the force required for exerting both downward and upward movement is substantially less than that being exerted at the push-rod heads.

f) A beneficial by-product of the design of this aerator is that it is much lighter than other power aerators and is therefore more manoeuvrable.

Description with reference to accompanying drawings

FIGURE 1 shows a view of the drill bit and with the drill bit held within a pulley

FIGURE 2 shows a side view of four complete drill bits mounted within the carousel

FIGURE 3 shows the drill cap and coiled spring

FIGURE 4 shows the main assembly

FIGURE 5 shows the base structure

FIGURE 6 shows the drill assembly

FIGURE 7 shows 2 views, A with drill & tine tube lowered, and B in its stationary position

FIGURE 8 shows the soil collection box

FIGURE 9 shows a side view of the lawn aerator

Figure 1 - shows a view of the drill bit 1 with a double claw and helical staircase design. Item 2 is the pulley. 3 is the thrower disc which deflects the soil particles down into the collection box via centrifugal force.

Figure 2 - shows four drill bits mounted on the carousel 7. 4 is the push tube which connects to a handle. 6 is the drill cap with pin inside to hold and drive the drill bit and 5 is a constant force spring biasing the drill into the drive pulley.

Figure 3 - shows the cap 6 with bearing which fits over drill bit, and 5 is the constant force spring set at a pre-determined load ensuring adequate force for drilling, but compliance should the drill bit hit a stone.

Figure 4 - shows the main assembly, 4 being the push-tube connecting the carousel to the handle. 2 shows the pulleys which in this instance are driven by a timing belt. 8 is the static holding box. 9 where the drive pulley connects with the power source (not shown).

Figure 5 - shows the base structure with eight holes to take the eight drill bits, the particular size for this embodiment. 10 are the tubular members that guide the push tubes. 11 is the spider, our location device, whose arms each hold a hollow tine tube for debris guidance and axis control.

Figure 6 - shows the complete drill assembly with 12 being the tine tubes being held in place by the spider arms.

Figure 7 - shows a split sectional view of the main assembly. Side B, the right half of the diagram, shows the 'wavey-washer' type springs 13 that bias the first stage of the double downward action. 14 is a gas strut, the second stage, which biases the whole drilling system to home position. Side A, the left half, shows the drill bit 1 and tine tube 12 when placed down to the ground. This is achieved by when the push tube is pushed down, the drill assembly moves

down against the 'wavey-washers' 13 a fixed distance in order for the tine tubes to make firm contact with the lawn. As the push tube continues downward, the gas strut 14 allows the drill bits to enter the soil while the tine tubes 12 remain on the surface.

Figure 8 - shows the soil collection box with the eight holes through which the drill bits and tube tines pass 15.

Figure 9 - shows a side view of the lawn aerator. 16 is a handle which lifts the whole drilling assembly enabling 17 the soil collection box to be removed and emptied. 18 are the rear wheels attached to an extended frame for when the handles are pulled down to commence drilling, the wheels act as a balancing resistance to ensure the assembly does not lift.

Claims

1. A device intended for the cutting of holes in a medium of soils or similar, which produces said holes by a cutting action rather than punching, or compressing the medium, for the intention of aerating the medium. The device comprises sets of drills with hollow tine tubes to facilitate the movement of the cut medium up into a collection box, the whole assembly being pushed down into the soil by extended handles, with extended wheels at the rear to act as a counter-balance.

2. The drill for producing these holes as claimed in Claim 1 comprises of a cutting-bit for the device with claws to enable a scooping action, followed by a body that is either twisted from the flat form, or otherwise fluted, to provide a helical staircase. The drill is rotated to produce the vertical shearing action for removal of the medium. The drill is introduced into the medium by a linear, or curvilinear, action, either by powered or manual means.

3. A device as claimed in Claim 2 wherein each drill bit has a thrower disc attached to deflect the upward moving soil particles.

4. A device as claimed in Claim 1 or Claim 2 wherein hollow tine tubes connect the surface of the lawn to the aerator's soil collection box, and control both the drill position to its rotating axis during linear travel and the movement of the debris to any collection area.

5. As claimed in Claim 1 or Claim 2, any singular drill and its drive mechanism would normally, but not necessarily, have the ability to comply with resistance to linear travel by movement or slippage within the driving mechanism against a force, which puts the drill in bias towards the cutting position. Such force may be produced by any suitable means.

6. A device as claimed in Claim 1 or Claim 2 wherein the push tubes have a double tension mechanism to enable two forces to activate the drills and tine tubes for both downward and upward movement.

7. A device as claimed in Claim 1 with a removable soil collection box through the bottom of which are a series of holes accommodating the tine tubes, wherein the box is mounted underneath the drilling assembly.

8. As claimed in Claim 1, a location device during the cutting operation may be either manual or an automatic system that measures the relative location of a footprint for a new set of holes.

9. A powered lawn aerator substantially as described herein with references to Figures 1-9 of the accompanying drawing.

Abstract

The aerator has several inventive steps, which are improvements over existing art, for providing cylindrical holes in lawns or similar type surfaces so as to both loosen earth compaction and collect the earth particles via a 'scooping' method in the form of a double claw at the tip of each drill. The aerator is a pedestrian machine which is powered by an electrical motor or petrol engine with a series of these special drill bits each encased within a hollow tine tube. Each drill is made from a thin metal plate of helical design to achieve the greatest space to convey the earth upwards through the tine tubes, which give the rotational force, and up into the soil box. The drills are driven by a series of pulleys, the whole being pushed in two stages down into the earth, and retrieved, by extended handles.

Figure 1/9 **Drill & Pulley**

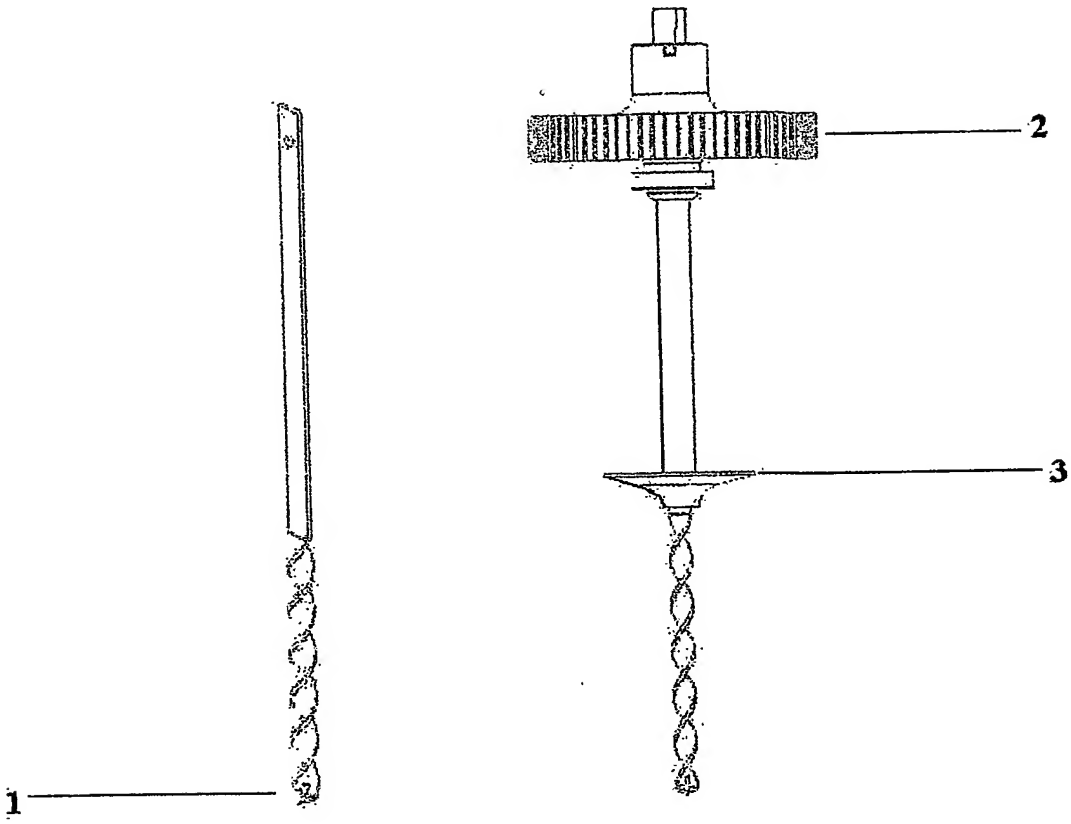


Figure 2/9 **Carousel Assembly**

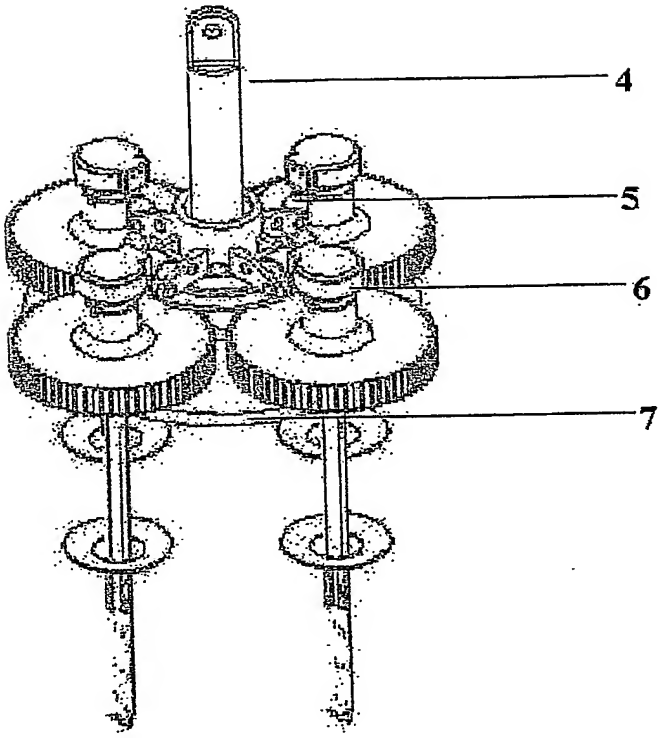


Figure 3/9 **Cap**

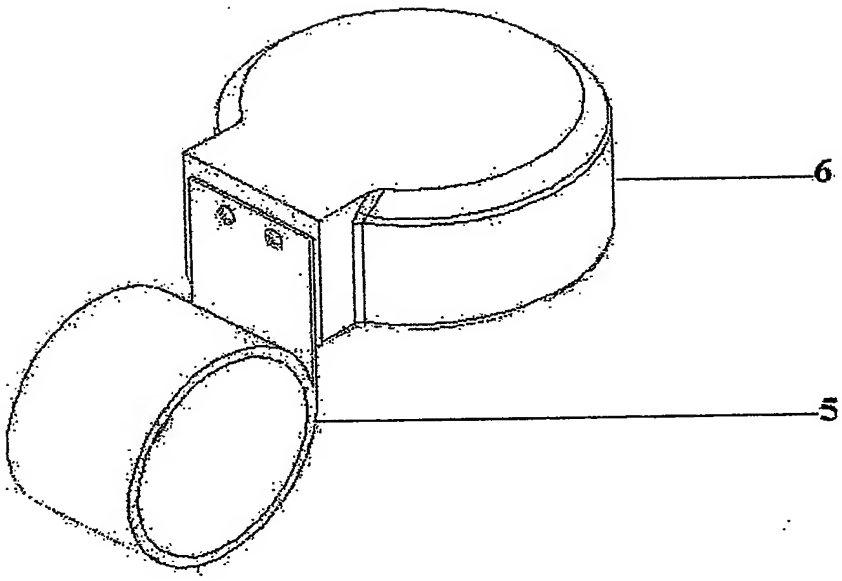


Figure 4/9 Main Assembly

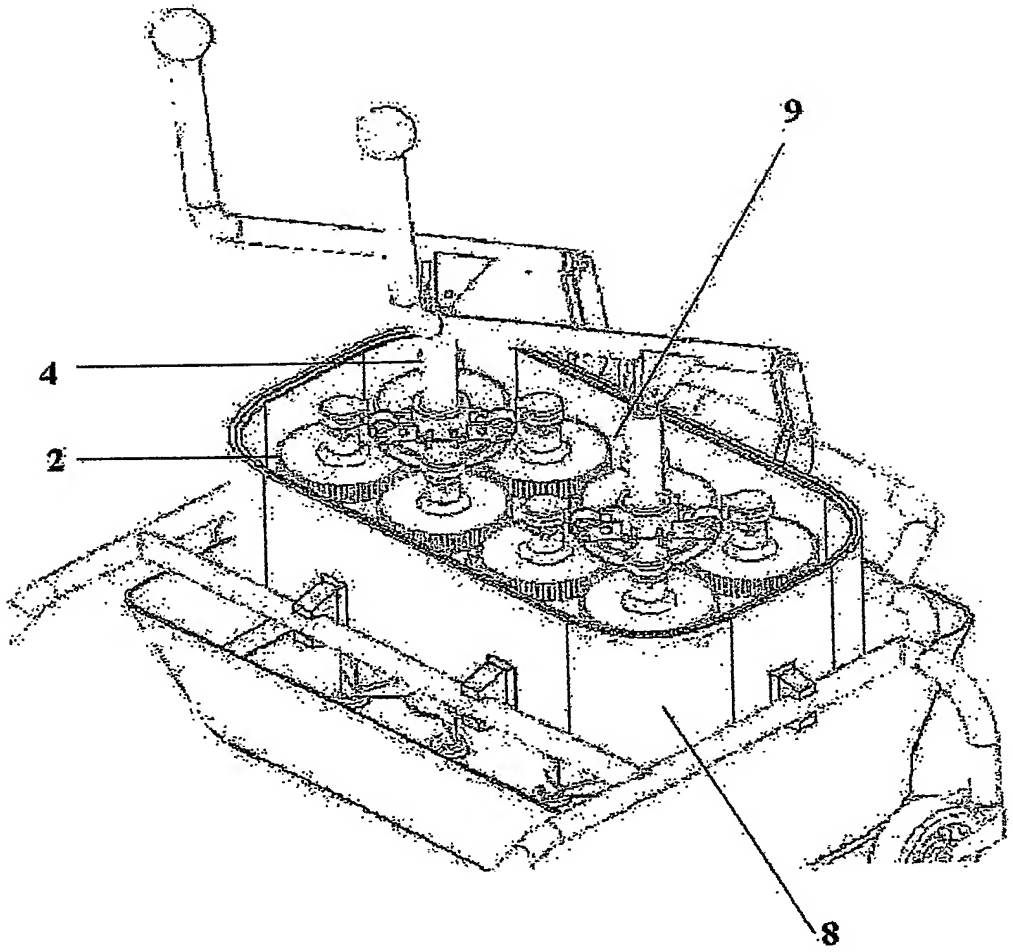


Figure 5/9 **Base Structure**

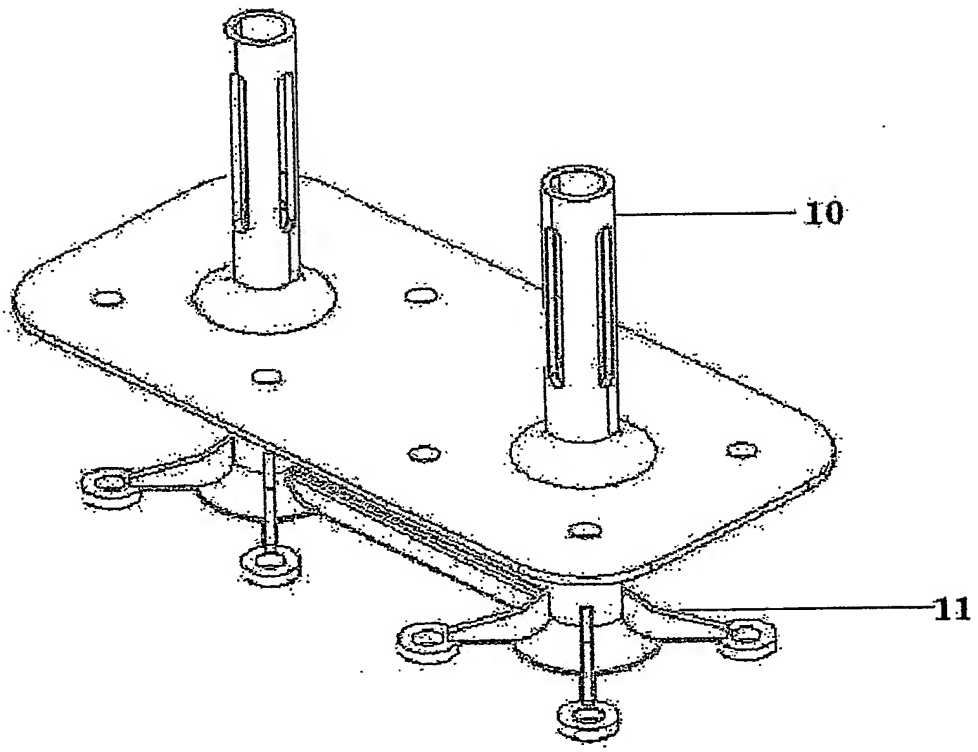


Figure 6/9 Drill Assembly

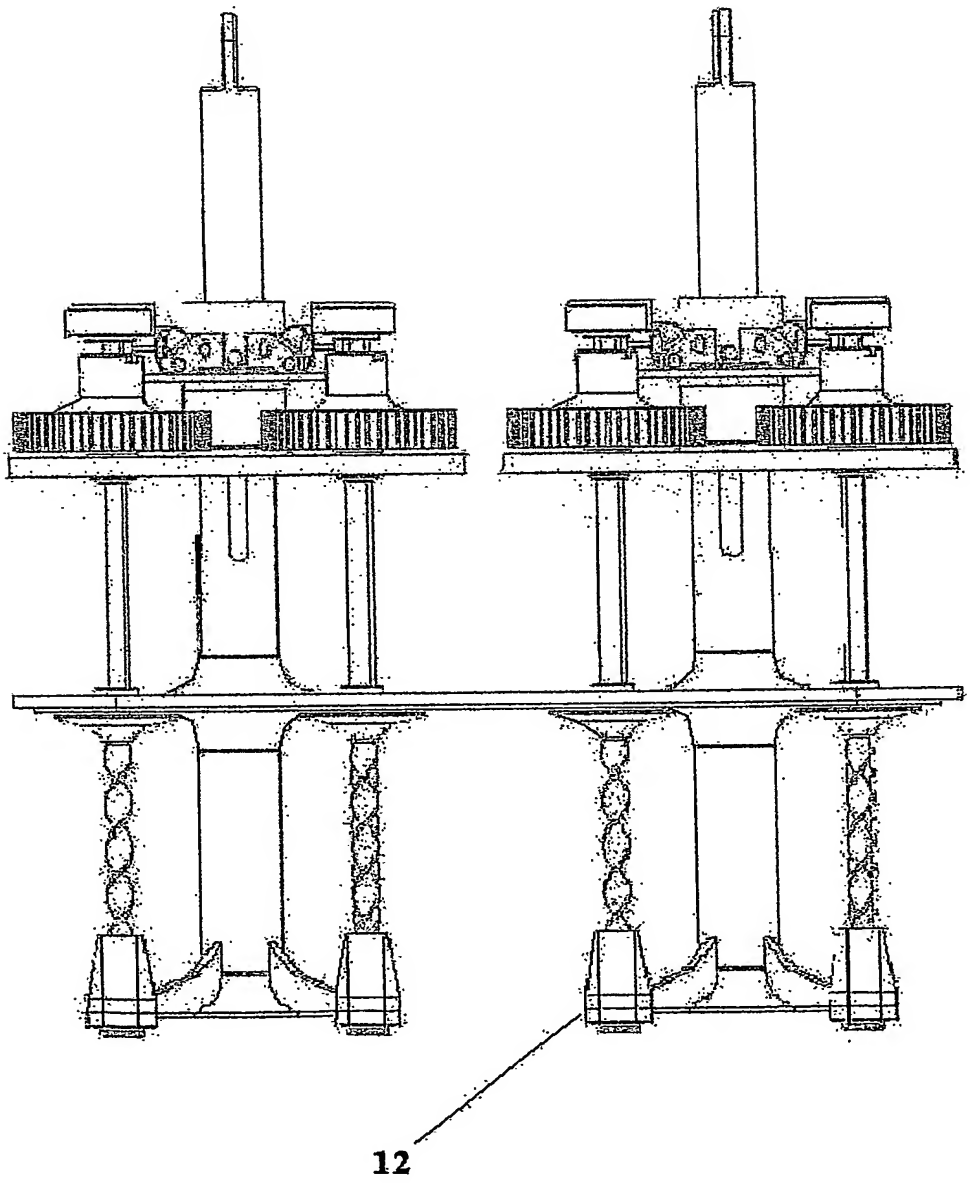


Figure 7/9 **Sectional View**

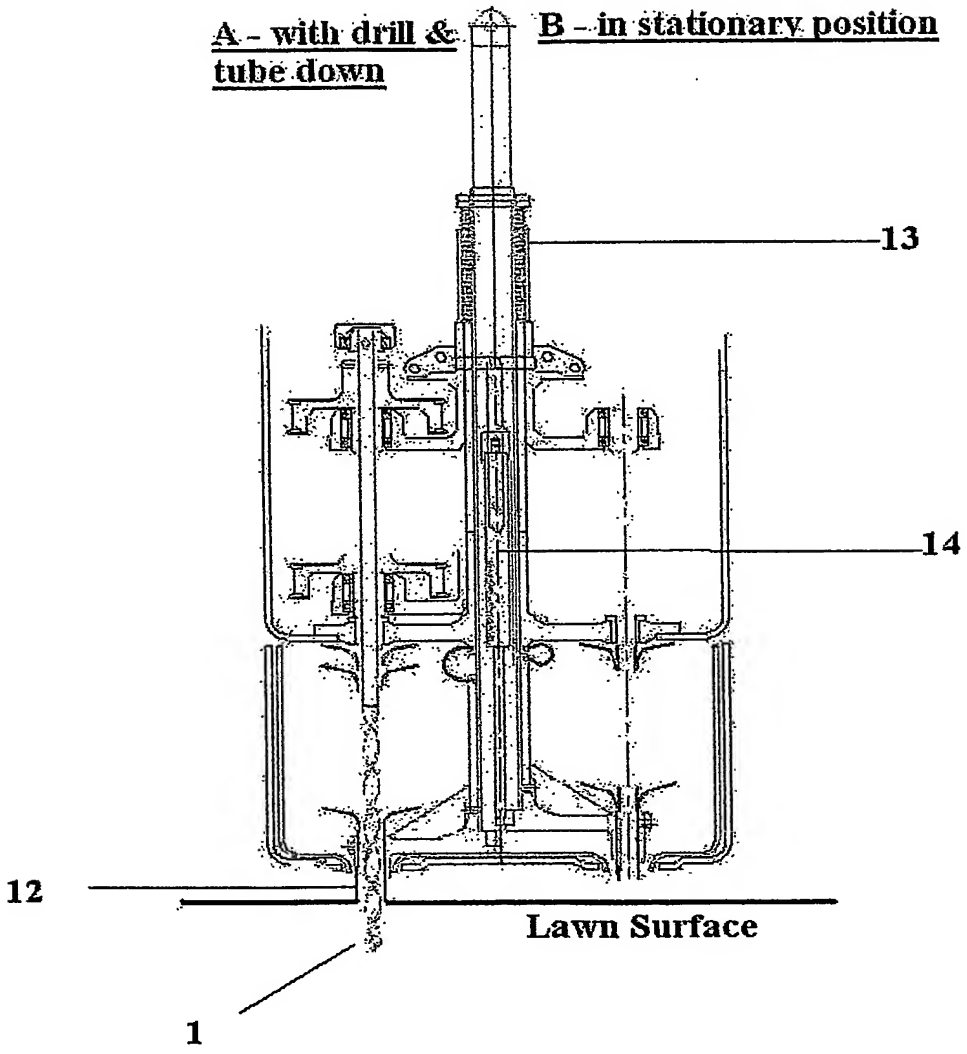


Figure 8/9 Soil Collection Box

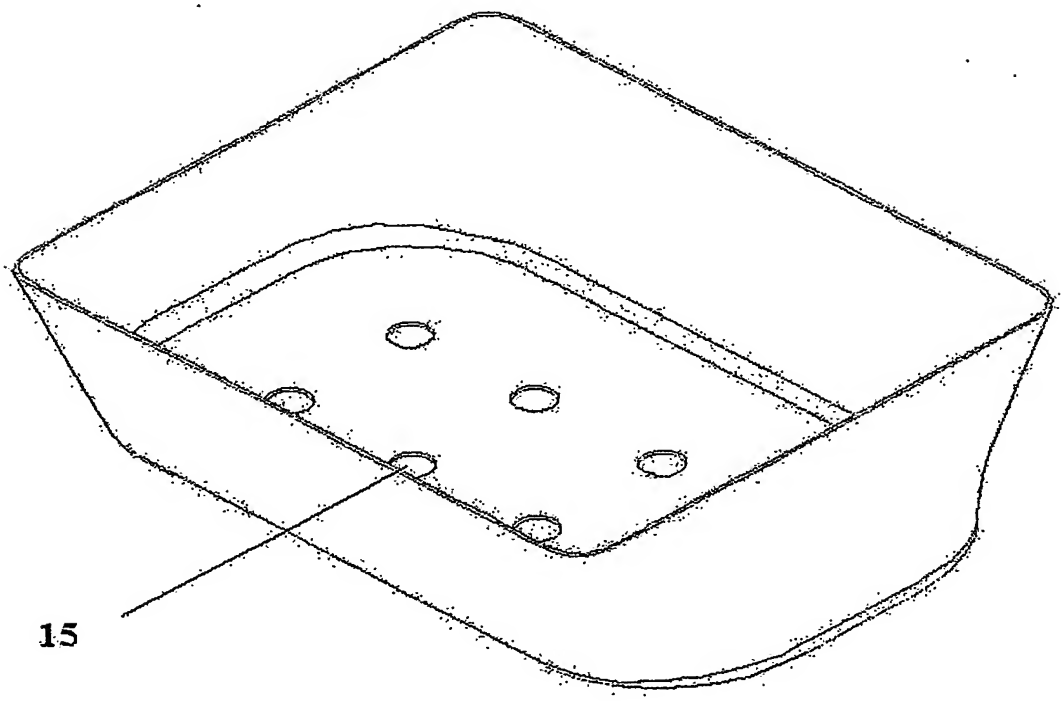
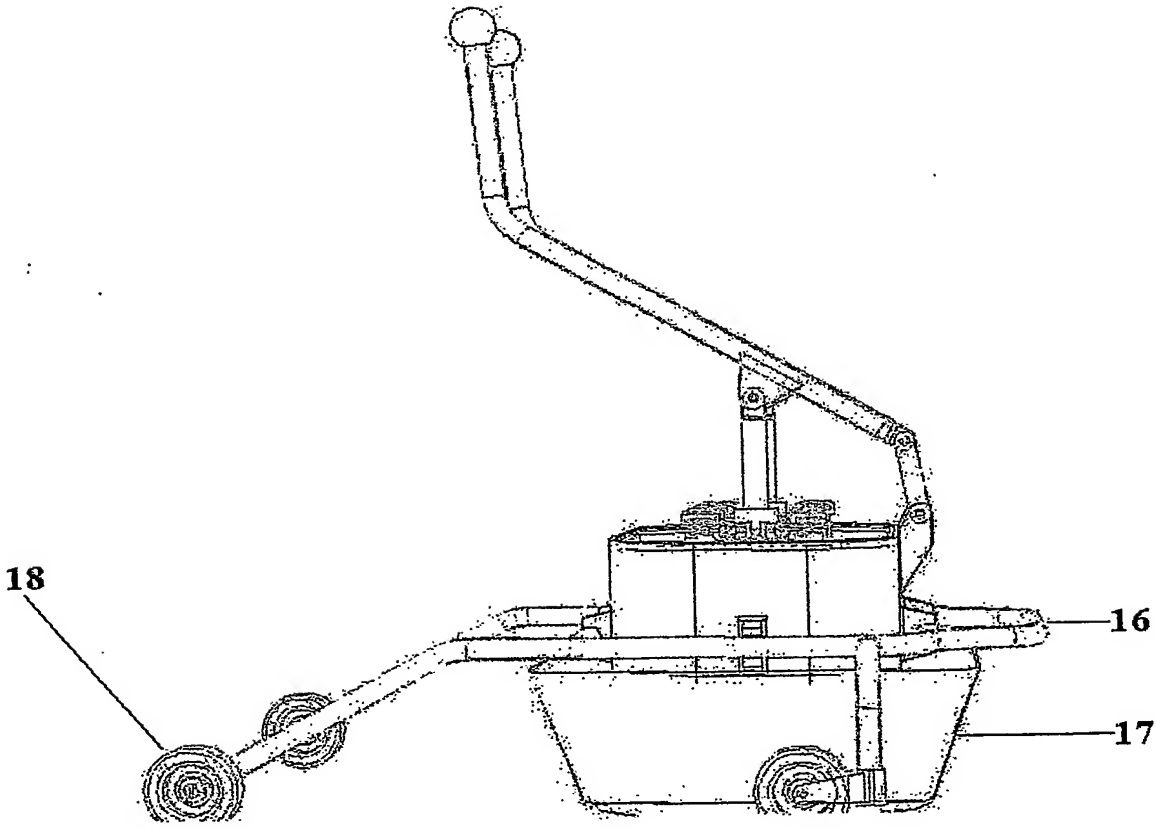


Figure 9/9 **Side View**



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